Electronic Version
Stylesheet Version v1.1.1

Description

APPARATUS CAPABLE OF POSITIONING A KEY BLANK RELATIVE TO CUTTING DEVICE IN MULTIPLE OPERATIONAL MODES

BACKGROUND OF INVENTION

[0001] The present application relates to key cutting, and more particularly to positioning key blanks during key cutting.

[0002] A key is a device, embodying a predetermined code, that functions to open a particular lock or a particular type of lock. Keys have many types, each with a particular size, shape, or modus operandi. One of the most common is a metal key, which includes a plurality of notches having predetermined depths and predetermined spacing therebetween. The spacing and depths of the notches represent the code embodied in the key.

[0003] Typically, a metal key is manufactured by applying a key blank to a cutting device, such as a cutting or grinding

wheel, and forming each notch according to the code. To duplicate a metal key, there are two options: First, a person privy to the key code can simply cut the pattern of notches into a key blank. This is called code cutting and is performed with a code cutting machine. Second, a person can use a key duplication machine. A key duplication machine utilizes the original key to guide the key blank relative to a cutting wheel to form notches having the same depths and spacing intervals as the notches on the original key.

[0004] Code cutting machines and duplication machines often stand alone. In other words, a code cutting machine does not perform duplication, and a duplication machine does not perform code cutting. This is burdensome for locksmiths who want to provide both code cutting and key duplication services to their customers. Accordingly, what is needed is an apparatus capable of positioning a key blank relative to a cutting device in both a code cutting mode and a duplication mode.

SUMMARY OF INVENTION

[0005] In one embodiment, an apparatus for positioning a key blank relative to a key cutter is provided. A frame having an axis has a carriage assembly attached thereto. The car-

riage assembly is arranged for movement in a generally axial direction and a generally transverse direction relative to the axis. A key blank holder is attached to the carriage assembly. A drive assembly is coupled to the carriage assembly for moving it in the generally transverse direction. The drive assembly has generally operable and inoperable conditions. A bias assembly also has operable and inoperable conditions. In a first operational mode, the bias assembly is inoperable, and the drive assembly is operable to impart transverse movement to the carriage assembly. In a second operational mode the bias assembly is operable to bias the carriage assembly toward the key cutter, and the drive assembly is inoperable.

[0006] In one embodiment, an apparatus for positioning a key blank relative to a key cutter is provided. The apparatus includes a frame having an axis. A means is provided for connecting the key blank to the frame such that the key blank is moveable in a direction generally axial and a direction generally transverse to the axis. A means is provided for biasing the key blank toward the key cutter, the biasing means having operable and inoperable conditions. A means is provided for driving the connecting means. The driving means includes operable and inoperable con-

ditions. In a first operational mode, the biasing means is inoperable, and the driving means is operable to impart transverse movement to the connecting means. In a second operational mode the driving means is inoperable and the biasing means biases the connecting means toward the key cutter.

[0007] In one embodiment, a key cutting machine having a duplication mode and a code cutting mode is provided. The machine includes a frame, a key cutter mounted to the frame, a carriage moveably attached to the frame, and a key blank holder positioned on the carriage. A gauge is mounted to the frame that measures a location of the carriage assembly relative to the key cutter. An engagement member is moveably attached to the carriage. The engagement member is moveable between a first position, corresponding to the code cutting mode, in which it engages the gauge, and a second position, corresponding to the duplication mode, in which it is disengaged from the gauge.

Brief Description of Drawings

[0008] Fig. 1 is a top perspective view of a key cutting machine while in code cutting mode;

[0009] Fig. 2 is a top perspective view of the key cutting machine

in Fig. 1 while in duplication mode;

[0010] Fig. 3 is a sectional view taken along the line 3-3 of FIG. 1;

[0011] Fig. 4 is a sectional view taken along the line 4-4 of FIG. 2;

[0012] Fig. 5 is an enlarged sectional view taken along line 5-5 of FIG. 1; and

[0013] Fig. 6 is an enlarged sectional view taken along line 6-6 of FIG. 2.

DETAILED DESCRIPTION

[0014] Referring to Figs. 1, key cutting machine 10 in one example comprises frame 20, carriage assembly 30, transverse drive assembly 50, axial drive assembly 60, display assembly 70, cutting assembly 80 and motor assembly 90.

[0015] Frame 20 is shown in Fig. 1 for exemplary purposes as a housing 21 having sidewalls 22, and end walls 24, which define an enclosure. Some components (e.g. carriage assembly 30) of key cutting machine 10 are shown mounted externally to housing 21, whereas others (e.g. portions of display assembly 70) are internal to housing 21. This is shown for illustrative purposes only. Alternatively, key cutting machine 10 could have another arrangement. For example, frame 20 could comprise one or more support

members attached to a base with the components of key cutting machine 10 attached to the support member(s). Frame 20 can be made of any material sufficient to support the components of key cutting machine 10 such that it can operate to produce keys. Examples include, but are not limited to, metals, stainless steel, and plastics. Frame 20 includes at least one axis 25 upon which carriage assembly 30 pivots.

[0016] Carriage assembly 30 is mounted to frame 20 such that it moves axially and transversely relative to axis 25. Carriage assembly 30, in one example, comprises first body member 32, a second body member 34, first shaft 36, second shaft 38, third shaft 40, and slide member 42. Carriage assembly 30 is attached to frame 20 by first shaft 36. First shaft 36 is connected on one end to first body member 32 and is pivotally and slidably disposed on frame 20. First body member 32 and second body member 34 are attached together by second shaft 38 and third shaft 40. Slide member 42, in one example, is a collar or cylindrical piece of material disposed on third shaft 40 and capable of sliding longitudinally along the length of third shaft 40. As will be discussed further herein, slide member 42 engages with display assembly 70 to provide

a user with a measure of the relative location of carriage assembly 30 with respect to cutting wheel 82 located in cutting assembly 80. A key blank holder 44, shown holding key blank 45, is attached to first body member 32, and a key holder 46 for holding a key to be copied, is attached to second body member 34.

[0017] Transverse drive assembly 50 operates to move carriage assembly 30 in a direction transverse to axis 25. Transverse drive assembly 50, in one example, comprises a support shaft (not shown), knob 52, handle 54, and lock pin 56. The support shaft, as will be discussed further herein, is rotatably engaged with frame 20. Knob 52 is attached to the support shaft. In code cutting mode, when knob 52 is rotated clockwise, it bears against carriage assembly 30 and moves carriage assembly 30, in a transverse direction relative to axis 25, toward cutting assembly 80.

[0018] Handle 54 is rotatably attached to knob 52. A user grasps handle 54 to rotate knob 52. Handle 54, as will be discussed further herein, also has two positions relative to knob 52. In one position (shown in Fig. 1), handle disengages a bias assembly (not shown) and cutting machine 10 is operable for code cutting. In another position

(shown in Fig. 2), handle 54 activates the bias assembly. The bias assembly then forces carriage assembly 30 toward cutting assembly 80 and cutting machine 10 is operable for key duplication.

[0019] Lock pin 56 is located in an opening of knob 52. Lock pin 56 is adjustable. Lock pin 56 has a first position, shown in Fig. 5, in which lock pin 56 is retracted from frame 20. This position is appropriate for code cutting. Lock pin 56 also has a second position, shown in Fig. 6, in which one end of lock pin 56 is engaged with frame 20 and knob 52 cannot rotate. This position is appropriate for duplication.

[0020] Axial drive assembly 60 moves carriage assembly 30 in an axial direction relative to axis 25. Axial drive assembly includes, a support shaft (not shown), knob 62, and handle 64. A user turns knob 62 through utilization of handle 64 to operate axial drive assembly 60.

[0021] Display assembly 70 includes a readout 72 and spring loaded plunger 78. Readout 72, in one example, includes space needle 73, space indicia 74, depth needle 75, depth indicia 76. Space needle 73 communicates with axial drive assembly 60, and in conjunction with space indicia 74, provides the axial location of key blank 45 relative to cutting assembly 80. Depth needle 75 communicates with

plunger 78, and in conjunction with depth indicia 76, provides the transverse location of carriage assembly 30 relative to cutting wheel 82.

[0022] Space indicia 74 and depth indicia 76 can be provided on separate code cards produced by the manufacturer key cutting machine or by some other party. The code cards provide the code for a particular key to be cut. Examples of the code cards and the mechanisms through which display assembly 70 works can be found in U.S. Patent Nos. U.S. Patent Nos. 4,117,763, 4,090,303, 4,012,991, and 5,054,350, which are hereby incorporated by reference.

[0023] When knob 62 is turned it engages a mechanism within frame 20 that causes carriage assembly 30 to move axially. In one example, the mechanism includes a steel shaft with embedded threads connected to knob 62 that transfers motion to an aluminum casting that has a dual purpose. The first purpose of the aluminum casting is that it holds a rack that engages the spacing gear, which in turn moves the space needles 73. The other purpose of the aluminum casting is to connect to shaft 36 via a dog point screw, which allows for free depth motion while maintaining constant pressure by utilizing a spring to force the aluminum casting to be biased in one direction to ensure

accurate positioning. Shaft 36 is directly connected to carriage 30. This mechanism can be found in the above referenced patents.

[0024] Plunger 78 is mounted to frame 20 and is biased toward carriage assembly 30. In key cutting mode, slide member 42 is positioned in engagement with plunger 78. Plunger 78 biases carriage assembly 30 so that it remains in contact with knob 52 of transverse drive assembly 50. When a user operates transverse drive assembly 50, slide member 42 either depresses or withdraws pressure from plunger 78. Plunger 78 engages a mechanism within frame 20 to move depth needle 75 along depth indicia 76. In one example, plunger 78 is connected to a rack, which contacts a gear that is directly connected to depth needle 75. Accordingly, depth needle 75 moves along depth indicia 76 as plunger 78 is depressed and withdrawn. This mechanism can be found in the above referenced patents.

[0025] Cutting assembly 80 includes the cutting wheel 82, which is mounted to a shaft (not shown) engaged with motor assembly 90. Cutting wheel 82 rotates around the shaft and also pivots in the direction indicated by arrow "A" to allow a user to make angle cuts. A pivot pin 86, connected to cutting assembly, allows a user to pivot cutting wheel 82.

[0026] Motor assembly 90 turns cutting wheel 82. In one example, motor assembly 90 includes a 110 V motor (not shown). The motor is attached to cutting wheel through a mechanism, such as a belt and shaft assembly, which causes motor to turn cutting wheel 82. Alternatively, other motors or other devices, such as hand cranks, could be used to turn cutting wheel. A deburring brush 92 can be attached to a shaft of motor assembly 90 which can be used to deburr a key after cutting.

[0027] A description of the operation of key cutting machine 10 while in code cutting mode is provided for illustrative purpose.

[0028] To code cut a key, a user inserts key blank 45 into key blank holder 44. The user chooses the particular code card, which corresponds to the key that the user intends to cut. The user inserts the code card into readout 72. The user must then place key cutting machine in the code cutting operational mode. Accordingly, if handle 54 on drive assembly 50 is not in the position shown in Fig. 1, the user places handle 54 in this position. If lock pin 56 is not in the position shown in Fig. 1, the user pulls lock pin 56 back to disengage it from frame 20. The user must also position slide member 42 into engagement with plunger

78. If slide member 42 is not in the position shown in Fig. 1, the user moves slide member 42 into engagement with plunger 78.

[0029] The user, by utilizing transverse drive assembly 50 and axial drive assembly 60, then moves carriage assembly 30 such that key blank 45 is in a desired position relative to cutting wheel 82. In the example shown, clockwise rotation of transverse drive assembly 50 causes knob 52 to bear against second shaft 38 of carriage assembly and rotate carriage assembly 30 relative to axis 22. This causes key blank 45 to move toward cutting wheel 82. Conversely, counterclockwise rotation of transverse drive assembly 50 removes the pressure of knob 52 bearing against shaft 38. Plunger 78 then pushes carriage assembly 30, and key blank 45, away from cutting wheel 82. Meanwhile, plunger 78 communicates with display assembly 70 to cause depth needle 75 to move relative to depth indicia 76, and thereby provide the depth of the notch cutting wheel 82 will make in key blank 45.

[0030] Clockwise rotation of axial drive assembly 60 causes carriage assembly 30 to move axially toward knob 62. Counterclockwise rotation causes carriage assembly 30 to move away from knob 62. Axial drive assembly 60 com-

municates with display assembly 70 to move space needle 73 relative to space indicia 74 as carriage assembly 30 moves. In this manner, user has an indicator of the longitudinal location of the notch that cutting wheel 82 will make on key blank 45. This allows the user to space the notches at appropriate distances from each other. It should be noted that the directions of rotation for both transverse drive assembly 50 and axial drive assembly 60 are provided for illustrative purposes. The directions of rotation could be reversed without departing from the scope of the application.

[0031] After moving key blank 45 to a desired spacing location, the user powers motor assembly 90 to turn cutting wheel 82, the user moves key blank 45 to the desired depth location, which then cuts a notch in key blank 45. Alternatively, the user can turn the power on first and then move key blank 45 to the desired position to make a particular cut. As will be understood by those in the art, the user makes a series of cuts on key blank 45 by utilizing transverse drive assembly 50 and axial drive assembly 60 to position key blank 43 in a number of positions relative to cutting wheel 82. The position of key blank relative to cutting wheel 82 is provided to the user by space needle

73, space indicia 74, depth needle 75, and depth indicia 76. In either case, the user makes the cuts on key blank 43 in accordance with the code provided on the code card.

[0032] Referring to Fig. 2, an exemplary description of key cutting machine 10 while in duplication mode will now be provided for illustrative purposes.

[0033] To duplicate a key, the user places key blank 45 in key blank holder 44 and key 201 in key holder 44. Before duplicating the key 201, the user must place key cutting machine in duplication mode. Accordingly, if handle 54 on drive assembly 50 is not in the position shown in Fig. 2, the user places handle 54 in this position. If lock pin 56 is not in the position shown in Fig. 2, the user pushes lock pin 56 forward to engage it with frame 20. Similarly, the user must also position slide member 42 so that it is not engaged with plunger 78. As will be discussed further herein, by positioning handle 54 as shown in Fig. 2, a pin 205 engages shaft 38 of carriage assembly 30 and biases it toward cutting wheel 82. This forces key 201 into engagement with a key tracer 203, which is mounted to frame 20. By positioning lock pin 56 in engagement with frame 20, transverse drive assembly 50 is disengaged. The disengagement of transverse drive assembly 50 pre-

vents rotation of knob 52, and prevents knob 52 from moving and interfering with the bias pin 205 applies to carriage assembly 30.

[0034] After engaging key 201 with key tracer 203, the user powers motor assembly 90. The user then rotates axial drive assembly 60 to move key blank 45 into engagement with cutting wheel 82. As will be understood by those in the art, as carriage assembly 30 moves axially, key tracer 203 traces the notch configuration of key 201.

[0035] Carriage assembly 30 maintains key blank 45 and key 201 in a fixed position relative to each other. Accordingly, when key tracer 203 causes the carriage assembly 30 to pivot away from cutting wheel 82, key blank 45 pivots away from cutting wheel 82. When pin 205 causes carriage assembly 30 to pivot toward cutting wheel 82, the key blank 45 pivots toward cutting wheel. In other words, the force of pin 205 pushing carriage assembly 30 toward key tracer 203, and the opposing force of key tracer 203 pushing against key 201, creates a cam-like action that causes carriage assembly 30 to move according to the spaces and depths of the cuts in key 201. This causes cutting wheel 82 to engage key blank 45 at the same locations and depths as key 201.

[0036] Referring to Fig. 3, axial drive assembly 50 includes knob 52 attached to support shaft 301. Support shaft 301 is positioned in openings 303, 304 formed in opposing sidewalls 305, 306 of frame 20. Support shaft 301 has threads 307, which engage threads 308 located in opening 304.

[0037] Plunger 78 is positioned in openings 310, 312 located in sidewalls 305, 306. Plunger 78 is biased by spring 314 toward carriage assembly 30.

[0038] When key cutting machine 10 is in code cutting mode, pin 205 (Fig. 2) is disengaged, allowing knob 52 to contact second shaft 38 of carriage assembly 30. Lock pin 56 is disengaged from detent 318 located on frame 20 and therefore knob 52 can rotate. Slide member 42 is positioned to engage plunger 78. As knob 52 is rotated, threads 307 on support shaft 301 engage threads 308, which depending on the direction of rotation, draw knob 52 toward or away from carriage assembly 30. If knob 52 is rotated clockwise, knob 52 engages shaft 38 and causes slide member 42 to compress spring 314 on plunger 78 and push key blank 45 toward cutting wheel 82. As knob 52 is rotated counterclockwise, knob 52 is drawn away from shaft 38 and key blank 45 will pivot

away from cutting wheel 82 due to the bias of spring 314.

[0039] Referring to Fig. 4, in duplication mode, pin 205 pushes against shaft 38 and carriage assembly 30 is biased toward cutting wheel 82. In code cutting mode, pin 205 is retracted within knob 52 and does not engage carriage assembly 30 (Fig. 3).

[0040] Further, in duplication mode, drive assembly 50 is disengaged by placing knob 52 in the locked position. Knob 52 is locked by engaging lock pin 56 engaged with the detent 318 to prevent clockwise or counterclockwise rotation of the depth crank. Because slide member 42 does not engage with plunger 78, plunger 78 does not bias carriage assembly away from cutting wheel 82.

[0041] Referring to Figs. 5 and 6, maintaining lock pin 56 in a "locked" or "unlocked" position may be accomplished by a variety of means. In the example, shown, a ball bearing 501 is positioned in a channel 503 located in the interior of knob 52. Ball bearing 501 is biased against the lock pin 56 by a resilient spring 505. Lock pin 56 has first grooves 507 to engage ball bearing 501 in a locked position (Fig. 6), and second groove 509 to engage ball bearing 501 in an unlocked position (Fig. 5).

[0042] As was stated earlier, pin 205, in duplication mode (Fig. 6)

pushes against shaft 38 to bias carriage assembly toward the cutting wheel. Pin 205 is part of a bias assembly that includes handle 54, pin 205, and spring 520. Handle 54, in one example, includes gripping portion 503 and intermediate portion 521. Handle 54 is rotatably attached to pin 205 at intermediate portion 521 by pivot pin 510. Pin 205 is disposed in a channel 511 located in knob 52. Spring 520 is attached to pin at one end by collar 512. At another end spring engages sidewalls 513 of channel 511. Spring 520 engages sidewalls 513 and biases pin 205 toward shaft 38.

[0043] Handle 54 pivots around pin 205, so that when gripping portion 503 is extended (as shown in FIG. 5), pin 205 is retained completely within channel 511. When gripping portion 503 is folded, spring 520 pushes one end 515 of pin 205 out of channel 511. Pin 205 thus engages shaft 38 (Fig. 6).

[0044] It should be noted that the particular arrangement of the bias assembly is shown for illustrative purposes only. The bias assembly could be a mechanism separate from knob 52 that engages carriage assembly 30 to push it toward cutting wheel 82 in one mode and disengages from carriage assembly in another mode. For instance, bias as-

sembly could be a spring mounted pin mounted to another portion of frame.

[0045] While particular embodiments have been shown and described, it will be apparent to those skilled in the art that changes and modifications may be made without departing from the broader aspects of applicants" contribution. The actual scope of the protection sought is intended to be defined in the following claims when viewed in their proper perspective based on the prior art.